

National Economic Education Database

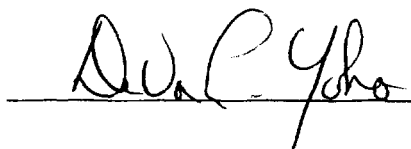
An Honors Thesis (HONRS 499)

by

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A handwritten signature in black ink, reading "DeVon L. Yoho", is written over a horizontal line.

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Purpose of Thesis

The project to develop the National Economic Education Database has one major goal: to offer a tool that economics educators can utilize to identify materials to enhance their teaching process. To facilitate that goal, I was tasked to design a database product to accommodate storing reviews of materials and allowing searches of the database of reviews. Actually developing the product involved three goals: to design, develop, and distribute a product allowing the entry of reviews; to design, develop, and distribute a product allowing searches on the database; and to design, develop, and implement a product allowing maintenance of the database. The following text describes the project from beginning to end, including history, plans and successful results of the project.

History. Initiated as a project of the Joint Council on Economic Education- an organization chartered to promote the enhancement of economic education throughout the nation - the first National Economic Education Database (NEED) project began 12 years ago. Funded by a grant from The Sears-Roebuck Foundation and coordinated by the Joint Council on Economic Education and the Center for Economic Education at the Krannert School of Management, Purdue University, NEED was originally developed at Purdue University to serve as a central database containing reviews of K-12 economic education curricula. Developed in 1982, the first version of NEED, ran on a Hewlett-Packard minicomputer. After that platform was removed from the university, a project to transfer NEED to a personal computer platform was initiated. In 1987, after a complete failure to migrate to the PC arena, the project was turned over to DeVon L. Yoho, Director of the Center for Economic Education at Ball State University.

When I became involved in the NEED project in the spring of 1991, the PC version of NEED was in its third revision. Unfortunately, before the project was complete, it would have to suffer another complete revision. Due to severe design limitations, the version that I inherited lacked certain functionality essential to the application, namely the ability to define and execute complex searches on the database.

After three years of unsuccessful attempts to develop NEED into a

PC application, I took over NEED, when Dr. Yoho asked me to make some modifications to the latest version of the project. During testing of that version, we became cognizant that the project had some serious flaws. Dr. Yoho and I discussed the alternatives and possible solutions to the problems inherent in the current version. As a result, my recommendation was to abandon the current version and utilize software development tools to engineer an application capable of meeting the original requirements of the project. In August of 1991 the decision was made to scrap the current version and begin to develop a new version of NEED to run on a PC.

Problem Definition. Developing a new version of NEED required an enumeration of all of NEED's functional requirements. At first this task seemed rather easy. To begin with, we determined that the software needed the capability to store reviews of various materials that could be used in economic education, such as textbooks, software programs, and audiovisual aids. Secondly, we concluded that the software should provide the capability to search the database on a number of different criteria. These two functions are the major activities of the software. However, further investigation revealed that the application needed much more functionality. The following list enumerates the specific functional requirements of the project:

1. Allow reviewers to enter reviews of economic education materials, including:

- a. Textbooks
 - b. Non-text, print materials
 - c. Single Activities, Lessons
 - d. Teaching Resources
 - e. Audiovisual Aids
 - f. Computer assisted instruction
 - g. Non-computer games and simulations
- 2. Allow reviewers to edit existing reviews.
 - 3. Allow reviewers to print hardcopy of reviews.
 - 4. Allow reviewers to download reviews to floppy disk.
 - 5. Allow end-users to search the database on any combination of the following fields:
 - a. Author
 - b. Title
 - c. Subject Area
 - d. Grade Level
 - e. Economic Concepts
 - 6. Allow database manager to the perform maintenance on the database, such as delete, backup, etc.

Once the functional requirements were outlined, it became apparent that three distinct software packages would need to be engineered: one to allow reviewers to enter reviews, referred to as the entry version; one to allow end users to search and view reviews, referred to as the user version; and one for the administrator to maintain the database, referred to as the admin version.

The Plan. After enumerating the requirements, I constructed a project plan. Given this list of requirements, I started constructing the solution on August 9, 1991, and intended to have a version ready for alpha testing by November 1, 1991. This goal may have been somewhat ambitious, but given the requirements as I understood them at the time, I believed it to be achievable. Even though previous attempts to develop a PC version of NEED had stumbled on for 3 years, I was still confident that a database could be designed and ready for testing in three months. Once alpha testing was complete, the software would be beta tested by actual users and later released as a commercial product to economic educators.

The Tool

I was absolutely convinced that the previous attempts at a PC version of NEED had failed mainly due to one factor: the right tools had not been utilized. Basically, NEED is a data storage and retrieval system. I saw no reason to use a low-level language such as C or Pascal to program NEED. Instead, I suggested the use of Paradox, a more appropriate environment. Paradox is a relational database management system from Borland International that is designed to allow users to create databases and database application, such as NEED. My predecessor on the project had chosen to use low-level languages which added the burden of dealing with a large amount of input/output routines to their task. I chose to employ a fourth generation language to alleviate those problems. Thus, I estimated that I could produce

an application in about 60% of the time it would take to use a low-level language.

The Problems. My initial goal of November 1 for an alpha version did not materialize. Attributed mainly to a lack of complete requirements definition, the delay in producing a commercial product is now mostly behind me. In late November, I discovered that I had omitted a complete section within the entry portion of the application. Within NEED, review materials are classified under a certain format type, such as visual aid, or computer-assisted instruction. Additionally, each of these formats has a more specific material format. For instance, a review item might be a visual aid. The specific material format may be videocassette. For the eight material format categories, 28 specific material formats exists. Unfortunately, I had not incorporated the design and implementation of the screens that collect information for these specific material formats into my original design. To make matters worse, each of these 28 formats could also fall into one of three categories: stand-alone item, part of a series, or an integrated item. To further complicate the data entry process, each of these three type required different information. Altering NEED to handle these additional characteristics required several additional months.

Though the first problem was attributed to a lack of complete understanding of the task, all succeeding problems were technical and attributable to the correct use of Paradox. In early

January, when a demonstration version of NEED was ready for review, Dr. Yoho and myself implemented plans to first demonstrate NEED to Dennis Weidenaar, at the Krannert School of Business at Purdue. Responsible for the coordination of the grant that has funded the NEED project, Dr. Weidenaar needed to see the current version before it could be release commercially. Unfortunately, the demonstration did not materialize at that time. While testing NEED, I uncovered a bug in Paradox which caused repeated data corruption. After conferring with several Paradox experts at Borland, I was finally able to find a solution that would not continually corrupt the database. However, to actually implement these changes in the code required another month.

After solving that major problem, another problem soon became apparent, this time in the user version. NEED requires the ability to perform complex searches on a large database. My initial solution functioned properly, until the size of the database was about a third of that intended. At this point, to search the database became an excruciatingly slow process. To change the search process so that it offered better performance required about 3 weeks of additional rework. However, NEED now performs almost as well with a fully populated database as it does on a small one.

Finally, the enormous size of the database made any fine tuning of the software very difficult. NEED requires seven disks for

distribution, uses 5 MB of disk space, and is comprised of 212 files. Even small changes at this point were very involved, since I had to first determine where in the application to initiate the change, and then insure that the interdependence of 212 files did not affect other files adversely.

The Results. At this time, NEED is being prepared for beta testing by actual users. After all feedback from users is collected, and appropriate updates installed, NEED will be released commercially late second quarter of this calendar year, or early third quarter. Also, an additional grant of \$10,000 is expected to be secured for the continued development and distribution of the product. By first quarter of 1993, NEED will be firmly entrenched as a popular and useful for economic educators.

The Lessons. Working on a project of this magnitude required a great amount of effective project management. Almost all difficulties encountered were due to lack of sufficient understanding of requirements, or poor planning to implement those requirements. The lessons learned from this realizations are by far the greatest benefit of this project. To see a project evolve from a wish list on paper to a tangible product produces a great feeling of success.

From a technical standpoint, the necessity of understanding the complete scope of the project, from the opening screen to the

final line of code, has provided me with a new-found appreciation for proper documentation. The first few hours spent sorting through code to find a bug inspired an increase in documentation effort.

From a business standpoint, understanding the interaction of all players involved has provided me with a new respect for computer software developers. Not only must the end user be appeased, but additionally, the project advisor, as well as those providing funding for the project must be satisfied. And, in the end, all parties involved with NEED will be pleased with it.